WHAT IS CLAIMED IS:

1. A method of forming a magnetoresistive sensor comprising:

a) forming a first magnetic lead of magnetic and electrically conductive material;

b) forming a second magnetic lead of magnetic and electrically conductive material;

c) forming a junction between the first and second magnetic leads, the junction formed of a magnetic and electrically conductive material; and

d) reducing the magnetic and electrical conductivity of an outer shell portion of the junction, thereby forming a constricted junction comprising a magnetic and electrically conductive junction core that is at least partially surrounded by the outer shell portion.

2. The method of claim 1, wherein the first and second magnetic leads and the junction are substantially coplanar.

3. The method of claim 1, wherein the forming steps a) – c) include forming a single layer of magnetic and electrically conductive material, and forming the first and second magnetic leads and the junction from the single layer of magnetic and electrically conductive material.

4. The method of claim 1, wherein the junction core includes a length defined by a distance separating the first and second magnetic leads, and a width that is perpendicular to the length and is substantially less than an average unrestricted magnetic domain wall width corresponding to the magnetic material of the junction core.

5. The method of claim 4, wherein the width of the junction core is approximately 20 nanometers or less.

6. The method of claim 4, wherein the width of the junction core is defined by opposing side walls of the outer shell portion of the constricted junction.

7. The method of claim 1, wherein the reducing step d) includes implanting ions of a non-ferromagnetic element into the outer shell portion of the junction.

8. The method of claim 7, wherein boron, phosphorous, gallium, chromium, or arsenic ions are implanted in the outer shell portion of the junction during the reducing step d).

9. A magnetoresistive sensor comprising:

a first magnetic lead formed of a magnetic and electrically conductive material;

a second magnetic lead formed of a magnetic and electrically conductive material; and

a constricted junction joining the first and second magnetic leads, the constricted junction including a junction core formed of magnetic and electrically conductive material, and an ion implanted outer shell portion that at least partially surrounds the junction core and has reduced magnetic and electrical conductivity relative to the junction core.

10. The sensor of claim 9, wherein the first and second magnetic leads and the junction core form an electrically conductive path having a resistance that is a measure of an applied magnetic field.

11. The sensor of claim 9, wherein the first and second magnetic leads respectively include first and second magnetizations that are oriented in first and second directions, the first direction being different from the second.

12. The sensor of claim 9, wherein the first magnetic lead, the second magnetic lead, and the constricted junction are substantially coplanar.

13. The sensor of claim 9 including a sensing current that is conducted through the junction core.

14. The sensor of claim 9, wherein the junction core includes a length that is defined by a distance separating the first and second magnetic leads, and a width that is perpendicular to the length and is substantially less than an average unrestricted magnetic domain wall width corresponding to the magnetic material of the junction core.

15. The sensor of claim 14, wherein the width of the junction core is approximately 20 nanometers or less.

16. The sensor of claim 14, wherein the width is defined by opposing side walls of the outer shell portion of the constricted junction.

17. The sensor of claim 9, wherein the first and second magnetic leads and the constricted junction are initially formed of a single magnetic material, and the outer shell is subsequently formed by ion implantation of the constricted junction.

18. The sensor of claim 17, wherein boron, phosphorous, gallium, chromium, or arsenic ions are implanted in the outer shell portion of the constricted junction to reduce the magnetic and electrical conductivity of the outer shell portion relative to the junction core.

19. A method of forming a constricted junction for use in a magnetoresistive sensor to join first and second magnetic leads that are displaced from each other and are each formed of a magnetic and electrically conductive material, the method comprising steps of:

a) forming a junction of magnetic and electrically conductive material joining the first magnetic lead to the second magnetic lead; and

b) reducing the magnetic and electrical conductivity of an outer shell portion of the junction, thereby forming a constricted junction comprising a magnetic and electrically conductive junction core that is at least partially surrounded by the outer shell portion.

20. The method of claim 19, wherein the forming step a) includes forming the junction substantially coplanar with the first and second magnetic leads.

21. The method of claim 19, wherein the junction core includes a length defined by a distance separating the first and second magnetic leads, and a width that is perpendicular to the length and is substantially less than an average unrestricted magnetic domain wall width corresponding to the magnetic material of the junction core.

22. The method of claim 21, wherein the width of the junction core is approximately 20 nanometers or less.

23. The method of claim 21, wherein the width is defined by opposing side walls of the outer shell portion of the constricted junction.

24. The method of claim 19, wherein boron, phosphorous, gallium, chromium, or arsenic ions are implanted in the outer shell portion of the junction during the reducing step b).

25. A constricted junction for use in a magnetoresistive sensor to join first and second magnetic leads that are each formed of a magnetic and electrically conductive material, the constricted junction comprising a junction core formed of magnetic and electrically conductive material, and an ion implanted outer shell portion that at least partially surrounds the junction core and has reduced magnetic and electrical conductivity relative to the junction core.

26. The constricted junction of claim 25, wherein the constricted junction is substantially coplanar with the first and second magnetic leads.

27. The constricted junction of claim 25, wherein the constricted junction and the first and second magnetic leads are formed of a single layer of magnetic material prior to the formation of the outer shell portion.

28. The constricted junction of claim 25, wherein the junction core includes a length that is defined by a distance separating the first and second magnetic leads, and a width that is perpendicular to the length and is substantially less than an average unrestricted magnetic domain wall width corresponding to the magnetic material of the junction core.

29. The constricted junction of claim 28, wherein the width of the junction core is approximately 20 nanometers or less.

30. The constricted junction of claim 28, wherein the width is defined by opposing side walls of the outer shell portion.